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EXAMINER	
MICHALSKI, JUSTIN I	
ART UNIT	**PAPER NUMBER**
2644	14

DATE MAILED: 07/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/587,612	FURUTA, SATORU	
	Examiner	**Art Unit**	
	Justin Michalski	2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-6,10-13,15-17,21-29 and 34-36* is/are rejected.

7)☒ Claim(s) *3,7-9,14,18-20 and 30-33* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 13-15, filed 28 April 2004, with respect to the rejection(s)of claim(s) 25 and 35 under 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of newly found art.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 4, 10, 12, 15, 21, 23-25, and 34-36 are rejected under 35 U.S.C. 102(b) as being anticipated by Crozier et al. (US Patent 5,742,927).

Regarding Claim 1, Crozier discloses a noise suppression device (Figure 4) comprising: a time to frequency converter (FFT, reference 3) configured to perform frequency analyzation of an input time domain signal for conversion to an amplitude spectrum; a noise spectrum unit (references 5 and 6) configured to obtain noise spectrum of the input time domain signal (Crozier discloses store 6 stores noise power spectrum) (Column 3, lines 32-34); a signal to noise calculator configured to obtain a signal to noise ratio from the amplitude spectrum and the noise spectrum (Crozier discloses estimating noise which consists of a proportion of noise and a proportion of

the power spectrum, i.e. signal to noise ratio; Col. 3, lines 31-35. Crozier further discloses changing scaling factor based on signal to noise ratio; Col. 3, lines 41-44); a perceptual weight controller configured to control, based on the signal to noise ratio, first and second perceptual weights (Although Crozier does not explicitly disclose a perceptual weight controller, Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio, Col. 3, lines 41-44. It is inherent that the device would contain a perceptual weight controller in order to vary the factors of α (i.e. first and second weights α_1 and α_2) as disclosed by Crozier); a spectrum subtractor (reference 7) configured to subtract from said amplitude spectrum (signal from 4 to 7) a product (multiplier 7) of said noise spectrum (signal from 6 to 8) and the first perceptual weight (α_1) as controlled by said perceptual weight controller; a spectrum amplitude suppressor (reference 20) configured to multiply a spectrum obtained from said spectrum subtractor (output of reference 7) by the second perceptual weight (α_2 multiplied at reference 20 through references 7', 9', 10', 21, and 22) as controlled by said perceptual weight controller; and a frequency to time converter (inverse FFT 10) configured to convert an output of said spectrum amplitude suppressor to a time domain signal.

Regarding Claim 4, Crozier further discloses the noise suppression device comprising a perceptual weight modifier (Although Crozier does not explicitly disclose a perceptual weight modifier, Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio, Col. 3, lines 41-44. It is inherent that the device would contain a perceptual weight controller in order to vary the factors

of α (i.e. first and second weights α_1 and α_2) as disclosed by Crozier) configured to modify the first and second perceptual weights based on a determination result as to whether an input signal is a noise or an audio component (Crozier further discloses speech detect 5 updates noise store 6 when speech is absent from the current signal (i.e. whether signal is a noise or an audio component) (Column 3, lines 12-15).

Regarding Claim 5, Crozier further discloses the spectrum subtractor is further configured to perform fill-up processing, when a subtraction result of said spectrum subtractor is negative or zero (Crozier discloses any resulting negative terms are set to zero, i.e. fill up processing) (Column 3, line 44), to a spectrum obtained by multiplying a third perceptual weight to a specified spectrum (Crozier discloses β determines the minimum power level or spectral floor, Column 3, lines 49-50).

Regarding Claim 6, Crozier further discloses specified spectrum is a noise spectrum (Crozier discloses β is multiplied to noise spectrum in Col. 3, line 48).

Regarding Claim 10, Crozier further discloses at least one perceptual weight is externally controlled or selected. (Crozier discloses that a value of 2.5 for α_2 works best at a signal noise ratio of 10dB, i.e. externally selected) (Sentence bridging columns 4 and 5).

Regarding Claim 11, Crozier discloses a noise similarity analyzer (speech detect 5) configured to obtain a coefficient based on a noise similarity level of the input time domain signal (detector produces control signal C (i.e. coefficient) which permits the updating of a store 6 with power spectrum when speech is absent from signal) (Col. 3, lines 12-15), wherein the noise spectrum unit (noise store 6) is further configured to

obtain the noise spectrum based on the coefficient and the amplitude spectrum (control signal C permits the updating of power spectrum) (Col. 3, lines 12-15).

Regarding Claim 12, Crozier discloses a method for noise suppression (Figure 4), comprising: generating an amplitude spectrum from an input time domain signal (FFT 3); generating a noise spectrum of the input time domain signal (FFT 3); determining a signal to noise ration from the amplitude spectrum and the noise spectrum (Crozier discloses estimating noise which consists of a proportion of noise and a proportion of the power spectrum, i.e. signal to noise ratio; Col. 3, lines 31-35. Crozier further discloses changing scaling factor based on signal to noise ratio; Col. 3, lines 41-44); controlling, based on the signal to noise ration a first perceptual weight and a second perceptual weight (Although Crozier does not explicitly disclose a perceptual weight controller, Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio, Col. 3, lines 41-44. It is inherent that the device would contain a perceptual weight controller in order to vary the factors of α (i.e. first and second weights α_1 and α_2) as disclosed by Crozier); subtracting (subtractor 7) from the amplitude spectrum (signal from 4 to 7) a product (multiplier 7) of the noise spectrum (signal from 6 to 8) and the first perceptual weight (α_1) controlled on the basis of the signal to noise ratio, to generate a noise-removed spectrum (output of reference 7); multiplying the noise-removed spectrum by the second perceptual weight (α_2 multiplied at reference 20 through references 7', 9', 10', 21, and 22) controlled on the basis of the signal to noise ratio, to generate a noise-suppressed spectrum (output of

20); and converting the noise-suppressed spectrum to an output time domain signal (Inverse FFT 10).

Regarding Claim 15, Crozier further discloses modifying the first perceptual weight and the second perceptual weight (Although Crozier does not explicitly disclose a perceptual weight modifier, Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio, Col. 3, lines 41-44. It is inherent that the device would contain a perceptual weight controller in order to vary the factors of α (i.e. first and second weights α_1 and α_2) as disclosed by Crozier), based on a determination result as to whether an input signal is a noise component or an audio component (Crozier further discloses speech detect 5 updates noise store 6 when speech is absent from the current signal (i.e. whether signal is a noise or an audio component) (Column 3, lines 12-15).

Regarding Claim 16, Crozier further discloses fill-up processing, when a subtraction result of said spectrum subtractor is negative or zero (Crozier discloses any resulting negative terms are set to zero, i.e. fill up processing) (Column 3, line 44), to a spectrum obtained by multiplying a third perceptual weight to a specified spectrum (Crozier discloses β determines the minimum power level or spectral floor, Column 3, lines 49-50).

Regarding Claim 17, Crozier further discloses specified spectrum is a noise spectrum (Crozier discloses β is multiplied to noise spectrum in Col. 3, line 48).

Regarding Claim 21, Crozier further discloses the step of controlling comprises; externally selecting one of the first perceptual weight and the second perceptual weight

(Crozier discloses that a value of 2.5 for α_2 has been found to work best at a signal noise ratio of 10dB, i.e. externally selected) (Sentence bridging columns 4 and 5) and a value of 2.5 for α_1 has been found to work best at a signal noise ratio of 10dB) (Col. 3, lines 41-43).

Regarding Claim 22, Crozier further discloses determining a coefficient from a noise similarity level of the input time domain signal (speech detect 5 produces control signal C (i.e. coefficient) which permits the updating of a store 6 with power spectrum when speech is absent from signal) (Col. 3, lines 12-15), wherein the step of generating the noise spectrum comprises: generating the noise spectrum based on the coefficient and the amplitude spectrum (control signal C permits the updating of power spectrum) (Col. 3, lines 12-15).

Regarding Claim 23, Crozier discloses a noise suppression device (Figure 4) comprising: a time to frequency converter configured to perform frequency analyzation of an input time domain signal for conversion to an amplitude spectrum (FFT 3); a circuit noise spectrum unit configured to obtain a noise spectrum of the input time domain signal (references 5 and 6); signal to noise calculator configured to obtain a signal to noise ratio from the amplitude spectrum and the noise spectrum (Crozier discloses estimating noise which consists of a proportion of noise and a proportion of the power spectrum, i.e. signal to noise ratio; Col. 3, lines 31-35. Crozier further discloses changing scaling factor based on signal to noise ratio; Col. 3, lines 41-44); a perceptual weight controller configured to control, based on the signal to noise ratio, first and second perceptual weights (Although Crozier does not explicitly disclose a perceptual

weight controller, Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio, Col. 3, lines 41-44. It is inherent that the device would contain a perceptual weight controller in order to vary the factors of α (i.e. first and second weights α_1 and α_2) as disclosed by Crozier); means for subtracting (subtractor 7) from the amplitude spectrum (signal from 4 to 7) a product (multiplier 8) of the noise spectrum (signal from 6 to 8) and the first perceptual weight (α_1) as controlled by the perceptual weight controller; means for multiplying (reference 20) a spectrum obtained from the means for subtracting (output of reference 7) by the second perceptual weight as controlled by the perceptual weight controller (signal from α_2 to reference 20); and a frequency to time converter configured to convert an output of the means for multiplying to a time domain signal (Inverse FFT 10).

Regarding Claim 24, A noise-suppressed time domain signal (Figure 4, signal 13) generated by a noise suppression method comprising: generating an amplitude spectrum from an input time domain signal (FFT 3); generating a noise spectrum of the input time domain signal (FFT 3); determining a signal to noise ratio from the amplitude spectrum and the noise spectrum; controlling, based on the signal to noise ratio (Crozier discloses estimating noise which consists of a proportion of noise and a proportion of the power spectrum, i.e. signal to noise ratio; Col. 3, lines 31-35. Crozier further discloses changing scaling factor based on signal to noise ratio; Col. 3, lines 41-44), a first perceptual weight and a second perceptual weight (α_1 and α_2); subtracting (subtractor 7) from the amplitude spectrum (signal from 4 to 7) a product (multiplier 8) of the noise spectrum (signal from 6 to 8) and the first perceptual weight (α_1) controlled on

the basis of the signal to noise ratio (Crozier does disclose varying the scaling factors α based on the signal to noise ratio, Col. 3, lines 41-44), to generate a noise-removed spectrum (signal output of 7); and converting the noise suppressed spectrum to an output time domain signal (Inverse FFT 10).

Regarding Claim 25, Crozier discloses a noise suppression device (Figure 4) for suppressing noise other than an objective signal contained in an input signal (Crozier discloses noise reduction; Col. 1, lines 9), comprising: means for controlling first and second perceptual weights for use in performing perceptual weighting, according to the input signal (Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio (which is a function of the input signal), Col. 3, lines 41-44); and means for performing a spectral subtraction (subtractor 7) on a signal corresponding to a spectrum of said input signal (signal from 4 to 7), using said controlled first perceptual weight (α_1, signal from 8 to 7), and for performing a spectral amplitude suppression (reference 20) using said controlled second perceptual weight (signal from α_2 to reference 20) about another signal corresponding to the spectrum of said input signal (signal from 4 to 7').

Regarding Claim 34, Crozier further disclose the device comprising means for performing perceptual weighting with the first and second perceptual weights according to the frequency of the spectrum of the input signal (Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio (which is a function of the frequency of the spectrum of the input signal), Col. 3, lines 41-44).

Regarding Claim 35, Crozier discloses a noise suppression method (Figure 4) of suppressing noise other than an objective signal contained in an input signal (Crozier discloses noise reduction; Col. 1, line 9), comprising the steps of: controlling first and second perceptual weights for use in performing perceptual weighting, according to the input signal (Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio (which is a function of the input signal), Col. 3, lines 41-44); performing a spectral subtraction (subtractor 7) on a signal corresponding to a spectrum of said input signal (signal from 4 to 7), using said controlled first perceptual weight (α_1, signal from 8 to 7), and a spectral amplitude suppression (reference 20) using controlled second perceptual weight (signal from α_2 to reference 20) about another signal corresponding to the spectrum of said input signal (signal from 4 to 7').

Regarding Claim 36, Crozier discloses a noise suppression device (Figure 4) for suppressing noise other than an objective signal contained in an input signal (Crozier discloses noise reduction; Col. 1, line 9), comprising: a perceptual weight controller configured to control first and second perceptual weights for use in performing perceptual weighting, according to the input signal (Although Crozier does not explicitly disclose a perceptual weight controller, Crozier does disclose varying the scaling factors α (i.e. perceptual weight) based on the signal to noise ratio (which is a function of the input signal), Col. 3, lines 41-44. It is inherent that the device would contain a perceptual weight controller in order to vary the factors of α (i.e. first and second weights α_1 and α_2) as disclosed by Crozier); a spectrum subtractor (subtractor 7) configured to perform a spectral subtraction on a signal corresponding to a spectrum of

said input signal (signal from 4 to 7), using said controlled first perceptual weight signal (α_1, signal from 8 to 7); and a spectrum amplitude suppressor (reference 20) configured to perform a spectral amplitude suppression using said controlled second perceptual weight (signal from α_2 to reference 20) about another signal corresponding to the spectrum of said input signal (signal from 4 to 7').

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier as applied to claim 1 above in view of LeBouquin ("Enhancement of noisy speech signals: Application to mobile ratio communications", Speech Communication, Elsevier Science publishers, vol. 18, no. 1, 1996, pages 3-19).

Regarding Claim 2, Crozier discloses a device as stated apropos of claim 1 above including varying perceptual weights based on signal to noise ratio. Crozier does not disclose the first and second perceptual weights becoming larger at certain frequencies with increased signal to noise ratio while letting the first and second perceptual weights be smaller at frequencies with reduced signal to noise ratios. LeBouquin discloses a method for noise reduction of a signal using spectral subtraction in order to get a more intelligible and pleasant signal to listen to. LeBouquin discloses

an algorithm which controls the subtraction factors (i.e. perceptual weights) (Page 2, Col. 2, lines 4-5). LeBouquin discloses varying α to obtain a less distorted speech signal (Page 7, Column 2, first paragraph) and increasing the value of α along with the SNR (Page 8, Column 1, lines 4-6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the value of the perceptual weight based on the SNR in order to produce a less distorted speech signal as taught by LeBouquin.

6. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier as applied to claim 12 above in view of LeBouquin ("Enhancement of noisy speech signals: Application to mobile ratio communications", Speech Communication, Elsevier Science publishers, vol. 18, no. 1, 1996, pages 3-19).

Regarding Claim 13, Crozier discloses a device as stated apropos of claim 12 above including varying perceptual weights based on signal to noise ratio. Crozier does not disclose the first and second perceptual weights becoming larger at certain frequencies with increased signal to noise ratio while letting the first and second perceptual weights be smaller at frequencies with reduced signal to noise ratios. LeBouquin discloses a method for noise reduction of a signal using spectral subtraction in order to get a more intelligible and pleasant signal to listen to. LeBouquin discloses an algorithm which controls the subtraction factors (i.e. perceptual weights) (Page 2, Col. 2, lines 4-5). LeBouquin discloses varying α to obtain a less distorted speech signal (Page 7, Column 2, first paragraph) and increasing the value of α along with the

SNR (Page 8, Column 1, lines 4-6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the value of the perceptual weight based on the SNR in order to produce a less distorted speech signal as taught by LeBouquin.

7. Claims 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier as applied to claim 25 above in view of LeBouquin ("Enhancement of noisy speech signals: Application to mobile ratio communications", Speech Communication, Elsevier Science publishers, vol. 18, no. 1, 1996, pages 3-19).

Regarding Claim 26, Crozier discloses a device as stated apropos of claim 25 above including varying perceptual weights based on signal to noise ratio. Crozier does not disclose controlling the first and second perceptual weights to let subtraction increase or decrease with a increasing or decreasing signal to noise ratio. LeBouquin discloses a method for noise reduction of a signal using spectral subtraction in order to get a more intelligible and pleasant signal to listen to. LeBouquin discloses an algorithm which controls the subtraction factors (i.e. perceptual weights) (Page 2, Col. 2, lines 4-5). LeBouquin discloses varying α to obtain a less distorted speech signal (Page 7, Column 2, first paragraph) and increasing the value of α along with the SNR (Page 8, Column 1, lines 4-6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the value of the perceptual weight based on the SNR in order to produce a less distorted speech signal as taught by LeBouquin.

Regarding Claim 27, Crozier further discloses means for performing perceptual weighting with the first and second perceptual weights according to the frequency of the spectrum of the input signal (Crozier discloses subtraction based on ω (i.e. frequency) of the input signal (Col. 3, lines 35-40).

Regarding Claim 28, Crozier further discloses means for performing perceptual weighting with the first perceptual weight according to a gradient in such a way as to let the subtraction amount decrease with increasing frequency of the spectrum of the input signal.

8. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier as applied to claim 25 above in view of Itoh et al. (Hereinafter "Itoh") (US Patent 5,757,937).

Regarding Claim 28, Crozier discloses a device as stated apropos of claim 25 above but does not disclose performing perceptual weighting with the first perceptual weight according to a gradient in such a way as to let the subtraction amount decrease with increasing frequency of the spectrum of the input signal. Itoh discloses an acoustic noise suppressor using spectral weighted subtraction. Itoh discloses using psychoacoustic weighting coefficient W(f) to minimize the degradation of processed speech quality (Figure 7; Column 3, lines 32-37 and 59-63). Itoh discloses figure 7 disclosing the weighting factor decreasing with increasing frequency of the input signal. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform weighting according to a gradient such that subtraction

amount decrease with increasing frequency of the input signal to minimize the degradation of processed speech quality as taught by Itoh.

Regarding Claim 29, Crozier further discloses varying the value of α, using a higher value for a lower signal to noise ratio (Col. 3, lines 41-44) thereby changing the gradient of α as a function of signal to noise ratio.

Allowable Subject Matter

9. Claims 3, 7-9, 14, 18-20, and 30-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Justin Michalski whose telephone number is (703)305-5598. The examiner can normally be reached on 8 Hours, 5 day/week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Isen can be reached on (703)305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JIM

FORESTER W. ISEN
SUPERVISORY PATENT EXAMINER